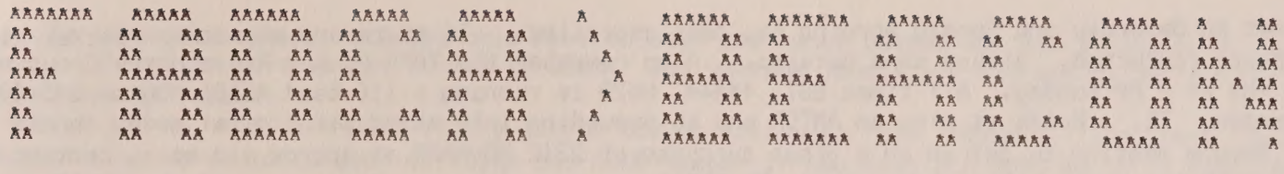


The FLORIDA AMATEUR DIGITAL COMMUNICATIONS ASSOCIATION Newsletter
Vol. 1, No. 2 Brandon, FL February 1984

RANDOM COMMENTS AND ITEMS OF INTEREST

Gwyn Reedy, W1BEL

Here it is folks, the second issue of the BEACON. FADCA is alive and growing rapidly, and until the printer is paid for this issue, we are in the black. Many thanks to all the people that have contributed time, articles and information, words of encouragement, and membership checks. We have 18 paid members and a mailing list approaching 100 persons. I consider all interested persons as members until we get more formally organized. Over 200 copies of the first issue of the BEACON have been mailed or distributed at hamfests. Presentations about packet radio were made at the Sarasota and Miami hamfests during the past month. Significant interest was shown at both locations and at Miami it took on a frantic aspect with ten or more hams visiting the display and asking questions all at once. The people manning the display loved it! During the next 30 days FADCA will make presentations at The Boys Club Hamfest in Pinellas Park on Feb 19, the Metro Repeater Club in Largo on Feb 23, the Stuart Free Hamfest on Feb 25, the Hernando County Hamfest in Brooksville on Mar 3, the Orlando Hamfest on Mar 10 & 11, and the Polk Experimenters Group in Lakeland on Mar 13. That is quite a bit of exposure for FADCA and packet radio. As time goes by we will be broadening the presentations to cover other forms of digital activity besides packet. At the moment, things are very busy as you can see.

I switched to a more dense type of print for this issue to allow about 20 percent more type per page, but it is not as easy to read. Let me know what you think.

Most of the interest in packet radio and AMTOR has been by experimenters and builders, but as more commercial equipment becomes available the communicators interest is kindled. Those persons that enjoy getting a signal into distant places under poor conditions get a big charge out of these error detecting modes. I think we need to begin to look at the public service aspect of these modes. I do not spend a lot of time in public service activities personally, but support them and commend those that participate regularly. Recently on a trip to the Washington, DC area I was shown a portable packet station by Terry Fox, WB4JFI. It consisted of a 2 meter hand-held, a modified Vancouver TNC (+12 v only operation), and a battery powered, fully portable computer. It all fits nicely in a briefcase, and can be put into operation in less than a minute. Think of the potential for error free, high speed emergency communication! In my travels speaking about packet radio, I have met many hams that are neither experimenters nor weak signal/DX type people that would be very interested in getting started in packet in public service work. There is a place for AMTOR in this area too, for lower quality signal paths. (See KF4EF's article in the next issue.)

As packet radio sees an exponential growth in Florida, I'm wondering what is the best way to link the centers of packet activity that are developing. K4NTA asks the same question in his column. At first (right now) it is advantageous to have all packet people on the same frequency, currently 147.465. Soon that frequency will become overloaded because of the greater density of packet stations, and the wide coverage expected from digipeaters currently going up on high towers. Since one of the purposes and advantages of the packet mode will be the ability to pass real time data to anyone else equipped for the mode, a good plan is needed to allow the use of additional frequencies for local activity without losing connectivity with those groups. I hope we don't let ourselves get into the situation where you have to know that city X is on frequency A and city Y is on frequency B, and one group in city X is not on either frequency A or B, etc. (It can and will happen all over the state if we don't plan.) Groups in New Jersey have planned linking work on 220 mHz, and people in the New England Packet Radio Association (NEPRA) are actively experimenting with 9600 baud FSK on that band. How do we allow improved coverage now on two meters and not soon obsolete our digipeaters with their high, high antennas by moving linking to another band? What are your ideas?

Short items: The FADCA net on 75 meters is at 8:30 AM, Sundays, at 3955-3960 KHz. Listen for K4NTA. K4AHO runs a FADCA net on the LMARC repeater (147.285 +6) every Sunday at 9 PM. KF4EF holds a FADCA net on the BARS repeater (147.165 +6) every Sunday at 7 PM. The previously announced 40

meter net on Saturday and Sunday morning has been cancelled. If there are any other packet/digital nets being conducted, please send details. Also remember the TAPR Packet Radio Users Group net on 21.280 kHz at 2 PM Sunday. All times EST. ***** N4ZQ is running a 110 baud ASCII MSO on 145.000 mHz in Brandon, FL. Keith is also on AMTOR and is providing info about all digital modes on his MSO. ***** Anyone wanting to get in on a group purchase of 2212 NOVRAMS at approx $18 each, contact W4APV at 8118 37th Ave North, St. Petersburg, FL 33710. ***** I have a few copies of the AX.25 protocol specification for anyone doing any software development. Send an 8 1/2 X 11 SASE with $1.00 postage for first class delivery. The spec is in the TAPR Kit manual so will be widely available soon. ***** WA4KXY, K4GFG, WA4FIB, and W1SL are members of the Fort Lauderdale Amateur Packet Radio group. (Hope I got all those calls right.) They have been doing some original development work on packet hardware and are operating on 70 cm with their gear using AX.25 protocol. Their gear supports higher data rates than the widely available gear and they have promised an article (soon) about their project. I don't want to spill the beans about their work, but it sounds like it has great potential for improved linking, satellite access, and other weak signal work. Stay tuned. ***** K4RHD, W4APV, and K4IJY are wire-wrapping Tucson TNCs, rather than wait for Kit delivery. ***** K4AHO in Altamonte Springs is developing a public domain terminal program for the C-64 that has file upload and download capabilities and is optimized for packet and landline use. ***** W9TD, WB4APR, and WORPK can be heard weekends on 10.140 mHz LSB doing 300 bps packets with 200 Hz shift.

BYTES FROM THE WRITE ONLY MEMORY Ted Huf, K4NTA

Well, the Miami Hamfest is history. Gwyn, W1BEL; George, WD4BRF; Nancy, WD4BRG; my XYL Mary Lou, and yours truly manned the FADCA booth at the Miami Hamboree February 4th and 5th. I can't begin to guess how many hams came by to get more information about this exciting new mode. We met some who already had Tucson kits on order and many more that only wanted to know where to get one and how fast it would come. Some of the areas that come to mind are Miami, Ft. Lauderdale, Boca Raton, West Palm Beach and the Florida West Coast. We even had a HH1 from Haiti come by to get information.

Just based on the comments from those who said they wanted to get a TNC and are willing to put up a digipeater with a high antenna, we will have a network covering south Florida in no time.

We also met a group from the Ft. Lauderdale area who are using AX.25 protocol but working on 70 cm using a manchester coded modulation. I want to find out more about this because I think that higher data rates could be received with lower signal to noise ratios than with the Bell 202 modem that we use on the Tucson boards.

We need to start thinking about the high speed links to handle the intercity linking. As we grow we will find that 147.465 will get rather crowded even for packet. Any ideas out there about intercity relaying, perhaps on 220 or 432 at 19.2 Kb or higher?

How about you guys who operate the satellites? Wouldn't it be neat to have gateway stations in every area to uplink and downlink from the local area network to the satellites.

Anyway, back to where we are today. We have packet operations springing up all over. We can digipeat through up to eight stations now to relay our packets, but if these stations have typical home installations on 2 meters, we will not get much range. We need to hear from people all around the state who can get an antenna up on a high tower or building and are willing to maintain the equipment for digipeaters. All in all there is a lot of work ahead but a lot of fun too.

THE GLB PK1 TERMINAL NODE CONTROLLER Ted Huf, K4NTA

About two weeks before the Miami Hamfest, I called GLB Electronics in Buffalo to ask some questions about their packet radio board and to order an instruction booklet. I had heard that they now had AX.25 as well as VADCG protocol. After a few minutes of conversation GLB agreed to send me an evaluation board to show at the Miami, Stuart, and Orlando hamfests in FADCA's packet radio displays.

The board arrived about six days before the Miami Hamfest, and after a quick look at the instructions, I had it on the air. Hookup to the radio and TRS-80 was a simple matter, but it took a while to figure out the strange commands. Strange because I have been using a Tucson beta board for almost a year. First contact was with myself via the K4NTA-1 digipeater and it connected on the first try. As I said the commands were a bit strange to me. In order to save memory, most commands are simple two letter abbreviations, some followed by a (D/E) for disable or enable. Others use a value either in hex, octal, or decimal.

The async port has an auto baud rate routine that works very well. I have tested it up to 4800

baud. To change the baud rate you only have to push the reset button and hit a couple of carriage returns. The async port is not a true RS-232K. The voltage levels are +12 and 0, but my TRS-80 RS-232 board worked fine.

Those of us who are used to the Tucson boards will miss the NOVRAM. The only operating parameter that is saved is your callsign and SSID number if you have GLB program it in the ROMS when it is purchased.

GLB chose to use the software approach in their design. Missing is the familiar WD1933 HDLC chip used on the Tucson boards (or the 8273 on the Vancouver model.) The processor is a Z-80A running at 3.58 mHz. The onboard modem uses the XR2206 and XR2211 chips. Equilization for the modem input is provided by a capacitor in series with the audio lead to the PK1. The board uses byte-wide RAMS. 4K was provided in the evaluation unit but it can be expanded to 14K. Power requirement is 12 volts at 200 mA. The basic price, wired and tested, is $149.95 but the evaluation model is priced about $200 and included the two 10-pin edge connectors, power supply, DB-25 connector and cabinet. Construction is first class, as are all the GLB products that I have seen.

More on the operation. A typical connect would go like this after the operating parameters are loaded into the RAM. First you enter the call and SSID number of the station you want to call by typing SDWD4BRF0(CR). Then if you want to connect through a digipeater you type SVK4NTA(space)1W1BEL(space)0(CR). This would set up K4NTA-1 and W1BEL as digipeaters. Assuming that your call is burned into the ROM, you then type AC and wait for the "connected to WD4BRT" message. The PK1 can handle up to 8 digipeaters. A linefeed is used to send the packet. This presented a problem for me because my terminal program does not send linefeeds, so in order to send a packet I have to hit escape and type AT (automatic transmit until ack).

Another major problem is that the PK1 runs only 600 or 1200 baud on the radio link. This would be a real problem for HF or satellite work. Another problem I noted is that if a packet is incoming and a keyboard key is struck, the packet will be missed. The missed packet will be picked up on the retry, but that could slow down throughput on a busy channel. A broadcast packet (one not expected to be acknowledged) would be lost for good since it would never be retransmitted. This problem occurs because the Z-80A software has to service both the keyboard and the link. The keyboard is given priority so that no keystrokes will be missed. The problem also occurs when your station is being used as a digipeater. When you are connected to another station and receive a connect request from a third station, you have no way of knowing it. Also, only two calls can be set up to be monitored, but you can monitor all activity on the frequency.

I don't want to sound too negative about the PK1. There are many features that are not on the Tucson boards. One real neat one is that you can use a Baudot TTY machine and the PK1 converts Baudot to ASCII. There is an optional 60 mA. loop board. There is a Queue mode where incoming packets and status displays are stored in RAM and can be saved to be read when you wish. This is something like sending (ctrl) S to a Tucson TNC. Two things that I miss are the automatic beacon and CW identification.

One feature that makes the PK1 attractive for remote digipeater use is that you can send command packets to a PK1 that is in digipeater service. That is, you can issue commands to change operating parameters via the radio link. You would need to do this in case of a power failure at the digipeater site. There is a block mode for transferring computer data. This must be something like the Tucson transparent mode but I did not test it.

GLB says in the instruction booklet "...it can do a better job with help from a host computer. The first priority should be given to off-line editing so that the PK1 can receive without keyboard interruptions." For the software hacker, this will not be a problem.

I guess the bottom line here, from a Tucson beta board user who must be a bit spoiled, is that I would rather pay the little bit more for a TAPR kit. If I had used nothing but a Vancouver board and its protocol, I would think the PK1 is the greatest.

GROUNDSTATION USERS' GUIDE FOR PACKET RADIO ON AMSAT-OSCAR 10

First Edition, Rev 1.00, September 16th, 1983

Compiled by Hank Magnuski, KA6M, Region 2 Coordinator, Digital Special Service Channel
311 Stanford Avenue, Menlo Park, CA 94025 (415)854-1927

INTRODUCTION TO THE AMICON NETWORK: Within hours of the opening of the AMSAT Oscar 10 (Phase III-B) transponder, packet radio enthusiasts began testing their ability to send digital data through the newest of the amateur satellites. The first reports came in from Ian Ashley, ZL1AOX, and were soon followed by tests and two-ways between stations in Maryland, California, New Jersey, and elsewhere.

The initial results were encouraging, and performance continues to improve as stations tweak their equipment and techniques.

This document is designed to be a guide to help users of the digital Special Service Channel and to assist newcomers in planning their equipment and operations. The origins of this document come from a message the author sent out in May of 1983 asking for information on stations interested in participating in AMICON.

This will briefly summarize the hardware and software required to transmit digital information through AO-10. It is still very early in the game, and much experimentation has yet to take place. Nobody has all the answers, and the reader certainly will not find them all here. A companion document, the AMICON Specification, is currently being revised and will be made available as soon as the editing is done and as soon as a little more operational experience accumulates.

The author will be very pleased to receive corrections, updates, and any other additional information which may be relevant to coordinating North American use of the digital SSC.

RF HARDWARE: Signal-to-noise ratio is the critical parameter for getting digital data through reliably. So a good groundstation will have lots of attention put into making sure that the "ears" are in top-notch condition. This means mast-mounted pre-amps, Gasfets if possible, and short cable runs. Antennas must be right-hand circularly polarized and pointed accurately. The general beacon should be heard at a level of 15 dB above the noise or better.

Transmitter output seems to be less of a problem, and should be adjusted to be received at a level slightly above that of the general beacon.

PACKET HARDWARE: Both Vancouver TNCs and TAPR TNCs may be used as packet controllers. The TAPR TNC currently has more flexibility in adjusting parameters such as packet lengths and delay times.

Most experiments have been conducted using standard 202 type modems, running at 600 or 1200 Baud, into an SSB transmitter. This technique works, but produces just marginally acceptable results, with reports of 80% to 95% copy. Users should not attempt AFSK-FM type transmissions. The bandwidth is too large and calculations show that the results would be worse than marginally bad.

Some AMICON groundstations have telemetry type PSK modems available, and others are planning experiments with new PSK and MSK designs.

It seems clear that at the moment, the design and availability of a good modem is the critical factor to the success of the AMICON channel.

PACKET SOFTWARE: Both the TAPR and Vancouver TNCs have implementations of the protocol agreed to at the AMSAT general meeting in October of 1982. This protocol is documented in the Proceedings of the Second ARRL Computer Networking Conference. The software for the VADCG TNC (LIPM/TIPM 5.1) is available through the AMSAT Software Exchange.

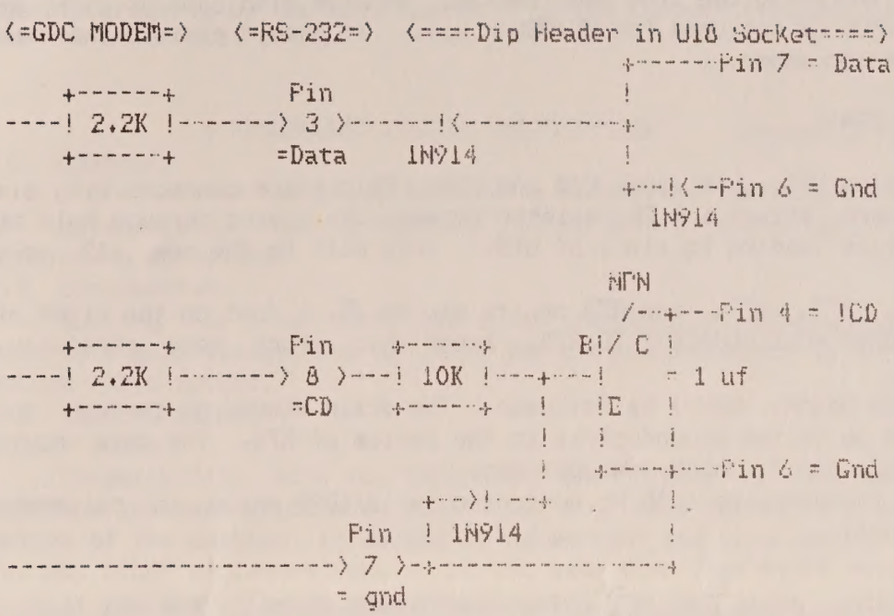
Stations have found that sending short packets tends to produce better results, a direction which is opposite the conclusion of theoretical studies which show that you get eaten alive by overhead with short packets, and the larger packets, the better. Clearly this is related to the signal-to-noise and modem issue, and more work and careful testing needs to be done.

This is an exciting frontier in personal communications and personal computer networking. You are invited to make a contribution.

(Ed.'s note: several detailed satellite paragraphs have been omitted to save space.)

CONNECTING A 202 MODEM TO THE TAPR BETA TNC: Very good luck has been experienced by replacing the XR2211 demod chip in U18 on the TAPR TNC with an external 202 modem. The external modem seems to produce much better copy in the presence of noise (like thru AO-10 satellite). The external modem used is one of the General DataCom model 202-5B units that WA2LQQ found available in the NJ/NY area about a year ago. Here is the documentation on the interconnecting circuitry.

The idea is to use diode clamps to convert data from RS232 to TTL, remembering that both pins 4 and 7 are pulled up to +5v on the TAPR TNC. The polarity of the data line is irrelevant since HDLC uses NRZI encoding. The Carrier Detect line must be inverted, so any old NPN transistor (e.g. 2N2222) can be used. The 1 uf cap across the !CD line prevents noise-induced interrupts and was found necessary to keep from fouling things up. The entire assembly (3 diodes, 1 transistor, 1 resistor, and 1 capacitor) was assembled on a 14 pin DIP header that replaces U18, but you may want to be more elegant and put it in a box. The two pin 6 = gnd lines are obviously tied together, but the computer graphix would have been messy to show this. The GDC modem had 2.2K resistors on its outputs -- they are shown above for completeness.



(Ed.'s note: remainder of document concerning duplex operation with the TAPR TNC is out of date and is not reprinted.)

STUART DIGIPEATER HAPPENINGS — George Crowell, WD4BRF

Some of you may be aware of the 'new' digipeater recently placed in operation in Stuart. Ted Huf, K4NTA, the Stuart Beta Test Coordinator has, through his persuasive manner, acquired an GE MASTR transceiver for use as the digipeater's 'ears' and 'mouth'. It speaks with about 55 watts into a four element beam at the 300 foot mark directed toward the Brandon/Tampa area. The smarts are handled by a TAPR board located at the transceiver. By the time this goes to press, the firmware will have been upgraded to the 3.1 version.

Several tests have been performed to determine the effectiveness of the digipeater installation. In several of these tests, voice and CW were passed between W1BEL in Brandon and the digipeater site in Stuart, a distance of 130 miles. The packets, however, initially met with marginal success. In order to dispell any concerns about the antenna installation on the tower, such as guy wires affecting the pattern, K4NTA and WD4BRF with the able help of their XYLs, performed a field strength measurement of the transmitted lobes. Field strengths were taken near field, 1/4 mile to one mile radius around the base of the tower, and far field, a circle of approximately 13 miles radius. In addition, several readings were taken at intermediate distances.

The results of these measurements appear to show no peculiarities or deviations from the expected pattern. The lobes are the strongest in front or toward Brandon/Tampa with significant attenuation toward the east. There is sufficient sensitivity on both the north and south sides to enable a station, N2WX, Howie, 60 miles to the north to successfully digipeat via the station.

Since the antenna seemed to be working well, we turned our attention to the GE MASTR. The deviation was tweaked up to approximately 5 KHz and the receiver and preamp were peaked. There was no significant change in the performance, leading us to conclude that the digipeater is performiong within design expectations. Band conditions have cooperated on several different occasions and one evening several Stuart stations were connecting with Brandon/Tampa stations, and short QSOs were possible via the K4NTA-1 digipeater.

The digipeater is up and available for any and all to use and is accessed by using the call K4NTA-1. With the new 3.1 firmware, many possibilities are on the horizon.

NEW MODEM DETAILS FOR THE TAPR TNC — Dan Morrison, KV7B via Ralph Wallo, WORPK.

...this note will describe in detail exactly what to do to convert your modem to the latest configuration. We've tested out the new design and it is MUCH better than the old one. Whereas before FM noise at the level of light popcorn was enough to kill communication, this is not true with the new modem. I have no doubt the modification below will make the modem operate properly on OSCAR 10, and will probably improve matters vastly on HF too.

In addition to the modifications improving the 1200 baud design, we have also come up with an optimized 300 baud design centered at 1700 Hz designed for HF/OSCAR use. It should exhibit the same good noise immunity that the 1200 Hz design shows.

For Kit boards:

1. Change C20 to .0047 microfarad (on U34)
2. Change R46 to 47K (also on U34)
3. Look carefully at the trace just below U21, just above C18 and R39. This trace connects U18, pin 7 to J5, pin 18. On the top of the board, attach a 4.7K resistor between the plated-through hole at the right end of this trace and the trace leading to pin 1 of U18. This will be the new +12 volt pullup on U18, pin 7.
4. Notice this trace passes under R76, R77, R79, and R78 on its way to J5. Just to the right of these resistors AND THE PLATED-THROUGH HOLE ADJACENT TO R78, break this trace very carefully, exposing about 1/16 inch of bare board.
5. Attach a VN10KM (available at Radio Shack, etc.) as follows: The drain should go through the plated-through hole. The source should go to the ground strip at the bottom of R78. The gate should be soldered to the trace coming from U18, pin 7, which was just cut.
6. Recalibrate the modulator center frequency to 1685 Hz by typing cal:3/1094 while in calibrate mode. This completes the modifications.

For Beta boards:

1. Change C25 to .0047 microfarad.
2. Change R14 to 47K.
3. Carefully lift the left end of R11 and re-attach it to the nearby +12 vole power bus on the wire-wrap area.
4. Add a 4.7K pullup resistor on the bottom of the board between U17, pin 27 and the nearby +5 volt trace attached to the .1 microfarad capacitor between U17 and U25.
5. On the top of the board, locate the trace coming from JP3 which goes to a plated-through hole near the left end of J3. Turn the board over and follow this trace until it ends at a plated-through hole under U17. This is the trace connecting JP3 and pin 27 of U17. Cut the trace near the plated-through hole under U17.
6. Attach a VN10KM under the board as follows: Attach the drain to the plated-through hole. Attach the gete to the trace leading back to JP3. Attach the source to pin 28 of U17 (the nearest ground).
7. Recalibrate the demodulator frequency to 1685 Khz, as above. This completes the modifications.

You should notice the modem requires much less audio than before, perhaps to the bottom of your volume control range. You should also find you're decoding weak signals much more reliably. Finally, you may find you can operate at hbaud greater that 1200. (Check for legality first!)

This modification is primarily due the the diligence of Eric Gustaffson, who made extensive measurements, and carefully analyzed his results. We take our hat off to him!

Modem Notes: The capacitor can be a garden variety ceramic, the resistor can be a 5 percent, 1/4 watt, and the mosfet can be a VN10KM, or an IRFDZ13, which is Radio Shack part number 276-2073. If the latter device is used, it can be mounted in the wire-wrap area of the beta board and the trace cutting instructions modified accordingly.

300 Baud Modem Modification.

For Kit boards:

1. Change C21 from .0022 to .01 microfarad.
2. Change R46 to 220K.
3. Change R37 on 2206 header to 22K.
4. Set high tone to 1800Hz (cal:2/1024).
5. Set low tone to 1600 Hz (cal:1/1152).
6. Set center frequency on the 2211 to 1700 Hz (cal:3).

For Beta boards:

1. Change C11 from .0022 to .01 microfarad.
2. Change R14 to 220K. (This can easily be done by making a jumper plug to fit over JP2 with 180K ohms (227K - 47K).
3. Change R28 to 24K to allow modulator low tone to be set to 1600 Hz.
4. Do steps 4 through 6 in the Kit board procedure above.

NOTE: Due to differences between the Kit and beta boards, the calibration lights will not

operate properly on the beta board. At the correct frequency one light will probably be out or dim, and the other will be on.

A HOMEBREWED PACKET RADIO SYSTEM

Howard Goldstein, N2WX

1.1 Abstract

I present the specifications for a homebrewed packet radio system. The reasons for my methods of implementation are presented, along with a status report on just how far along I am towards completing my system.

1.2 Introduction

Rolling one's own interface is an inexpensive and educational way to get on the mode. In this article I will discuss and document the progress made so far at N2WX on implementing a full featured packet radio system.

1.3 Specifications

1.3.1 Modes

Compatibility with the TAPR/AMSAT AX.25 frame and link level protocols is a requirement. The software implementation must run on the available system (i), and to take advantage of the multi-user nature of the machine, it should be re-entrant (to save memory) while supporting multiple connections for any other processes running at the same time that might desire a "QSO."

If you are thinking about homebrewing your own packet interface, don't worry if you don't have a full blown development system; don't let me scare you off with buzz words. Much of what I have done can be adapted for use on many single user home computers, even though the design was influenced by the multiple connection support requirement.

1.3.2 Methods

1.3.2.1 Hardware

The Zilog Z-8030 Synchronous Communications Controller (SCC) was used to implement the HDLC interface. Some advantages in using the Z-SCC are: Ease of availability, two independent full duplex channels (each with its own on-chip crystal oscillator, baud rate generator, and digital phase-locked loop), internal synchronization on HDLC flags, and internal CRC generation/checking, zero stuffing/deletion and abort generation/detection (2). However, some people may have trouble with the cost of the chip (approximately $45 at Jameco in January, 1984).

The author designed a board for the S-100 bus to interface with the Z-SCC, and to convert the TTL I/O on that chip to RS-232 for the Vancouver modem board (3). Timing for the Z-8030 was derived from the customary S-100 signals and proved to be quite complex because that particular Z-SCC expects to be plugged into a Zilog Z-BUS (4). Future designs will utilize the Z-8530 SCC which has the same communications features as the 8030 and shares the same command set, but is easier to interface to non-multiplexed buses.

1.3.2.2 Software

A software approach to the HDLC implementation was ruled out as being too time consuming for the host machine and the programmer. However, those interested in going that route may find Bob Richardson's (W4UCH) books (5) helpful in preventing wasteful "re-invention of the wheel."

OASIS C was chosen as the programming language for reasons of portability, flexibility, readability, and speed. All but the hardware and operating system primitives are written in C, and these are written as independent functions in assembly language. Moreover, C allows (I should say encourages) structured programming techniques which may ease the conversion to other (preferably structured) languages.

An onion-peel approach to the system simplifies the design and interface between operations that need to be performed (see fig. 1). Each layer is run concurrently with the others i.e. they are time-sliced by the processor periodically. Communications between layers are through control blocks which act as go-betweens carrying commands and statuses between adjacent layers (see fig. 2).

1.4 Progress

The frame level on down has been 'up' since the beginning of February, but because the link level isn't fully designed yet, little besides the printing of other ham's frames and the manual origination of discrete frames that get digipeated to myself has been done. I plan to document and keep FADCA informed of my progress.

If you have any questions please drop me an SASE. Howard Goldstein, PO Box 905, Melbourne, FL 32902-0905. Thanks, Howie.

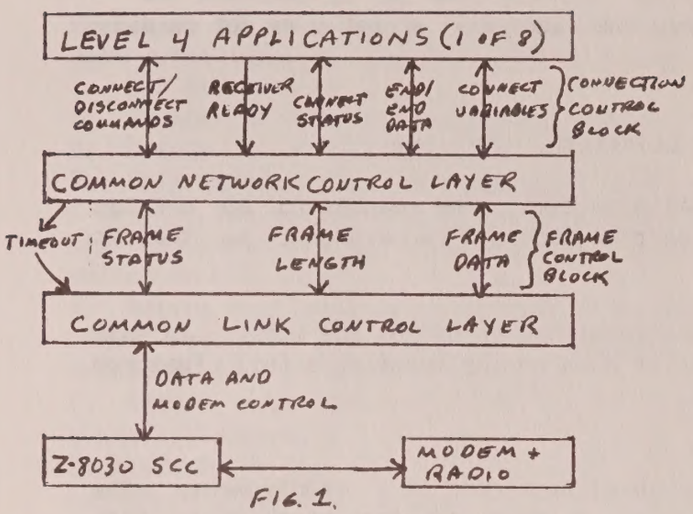


FIG. 1.

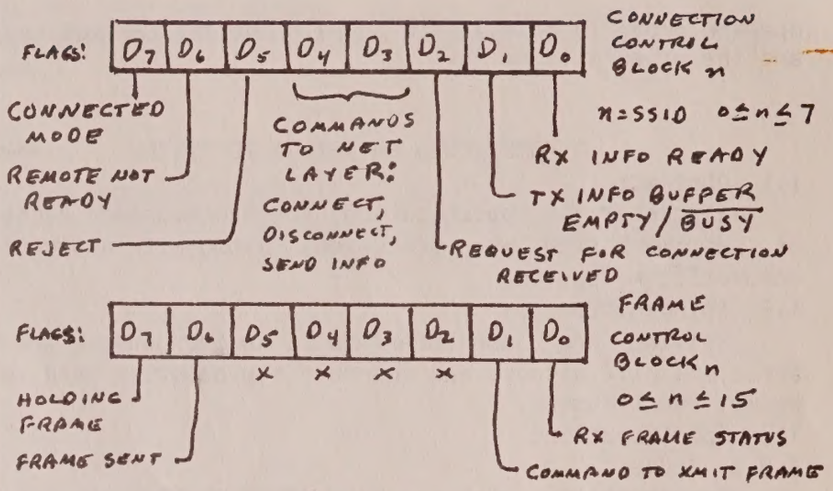


FIG. 2.

FOOTNOTES:

1. The system at N2WX is an SD Systems SBC-200 CPU (4 mHz Z-80A), 256 K bank switched RAM, OASIS multi-user operating system, dual 8" floppies.

2. 1982/83 Data Book, Zilog, Inc., 1982, Campbell, CA, page 175.

3. VADCG 202 type modem, speaks RS-232 and uses the EXAR chips. Bare board and documentation $15. See advertisement in Ham Radio Magazine, July 1983, page 73.

4. Data Book (see note 2 above), pp. 190-191, 475-491. The Z-BUS multiplexes the address and data lines in such a way that the on-chip register address is expected from the CPU on the combined address/data bus prior to any exchange of data; it's done with less than 10 chips (schematic for S-100 board interface to the Z-8030 SCC available for a SASE). However, non Z-BUS users may wish to examine the Z-8530 non-multiplexed Z-SCC.

5. Available through Richcraft Engineering, Ltd., #1 Wahmeda Industrial Park, Chatauqua, NY 14722.

ADDENDUM: Please note that the terms I used for the 2 layers I discussed (frame and link) are not in accordance with International Standards Organization (ISO) definitions. Please reference Dave Borden's (K8MMO) column, Data Communications, in QEX, July 1983, page 14.

This paper	ISO
Frame layer	Level 2 - Link control layer
Link layer	Level 3 - net control layer

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FLORIDA AMATEUR DIGITAL
COMMUNICATIONS ASSOCIATION
%Gwyn Reedy, W1BEL
812 Childers Loop
Brandon, FL 33511

HANK MAGNUSKI, KA6M

311 STANFORD AVE

MENLO PARK, CA 94025